

U.S. Patent Application Serial No. 10/775,216
Response filed August 14, 2007
Reply to OA dated May 2, 2007

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claims 1 - 28 (Canceled).

Claim 29 (Currently Amended): A multiple output power source apparatus comprising a plurality of power source circuits, each of the plurality of power source circuits being equipped with an independent output control circuits circuit, wherein

each of the output control circuits respectively comprises:

a shutdown circuit that detects an abnormality of own power source circuit to output an abnormality signal to output control circuits of one or a plurality of other power source circuits selected from the plurality of power source circuits via a first terminal, and inputting an abnormality signal outputted from the output control circuits of one or a plurality of other power source circuits via a first terminal to shut down the own power source circuit when an abnormality is detected either in the own power source circuit or in the other power source circuits, each of the output control circuits being operably coupled to each other.

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Claim 30 (Previously Presented): The multiple output power source apparatus according to claim 29, wherein

the plurality of power source circuits respectively comprises a converter that is driven by a switching circuit, converts an input voltage into a prescribed output voltage, and outputs the prescribed output voltage, and

the output control circuits respectively comprises an output stabilizing circuit that stabilizes the output voltage of the converter of the own power source circuit by monitoring the output voltage of the converter and controlling the switching signal.

Claim 31 (Previously Presented): The multiple output power source apparatus according to claim 30, wherein the output stabilizing circuit comprises:

a reference voltage generating circuit that generates a prescribed reference voltage;
an output voltage monitoring circuit that monitors the output voltage of the converter based on the reference voltage generated by the reference voltage generating circuit;
an oscillator that generates a clock signal having a prescribed frequency;
a driving circuit that controls the clock signal generated by the oscillator based on the monitored output of the voltage monitoring circuit to stabilize the output voltage of the power source circuit to a prescribed value, and

the shutdown circuit comprises:

an abnormality detecting circuit that is connected to a first terminal of the other power

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source circuits, outputs an abnormality signal to the first terminal when an abnormality of the own power source circuit is detected, inputs an abnormality signal outputted from the output control circuits of the other power source circuits, and stops oscillation of the oscillator when an abnormality of the own power source circuit is detected or when the abnormality is inputted from the output control circuits of the other power source circuits.

Claim 32 (Currently Amended): The multiple output power source apparatus according to claim 29 [[31]], wherein an oscillator in an output circuit of a master power source circuit of the plurality of the power source circuits is connected to an output circuit of a slave power source circuit selected from the plurality of the power source circuits via a second terminal, and outputs a synchronous oscillation signal synchronized with the clock signal via the second terminal, and an oscillator in an output control circuit of the slave power source circuit is connected to the output circuit of the master power source circuit via a third terminal, and inputs the synchronous oscillation signal outputted from the oscillator in the output circuit of the master power source circuit via the third terminal to perform synchronous control of the clock signal based on the synchronous oscillation signal.

Claim 33 (Currently Amended): A multiple output power source apparatus comprising a plurality of power source circuits, each of the plurality of power source circuits being equipped with an independent output control circuit, wherein

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each of the output control circuits respectively comprises:

a shutdown circuit that detects an abnormality of own power source circuit to output an abnormality signal to output control circuits of an other power source circuit selected from the plurality of power source circuits, and inputting an abnormality signal outputted from the output control circuit of the other power source circuit to shut down the own power source circuit when an abnormality is detected either in the own power source circuit or in the other power source circuits, each of the output control circuits being operably coupled to each other;

an output control circuit of a master power source circuit in the plurality of the power source circuits outputs a synchronous oscillation signal to a control circuit of a slave power source circuit selected from the plurality of the power source circuit; and

the output control circuit of the slave power source circuit inputs the synchronous oscillation signal outputted from the output control circuit of the master power source circuit to perform synchronous control with the control circuit of the master power source circuit based on the synchronous oscillation signal.

Claim 34 (Previously Presented): The multiple output power source apparatus according to claim 33, wherein

the plurality of the power source circuits respectively comprise a converter that is driven by a switching circuit, converts an input voltage into a prescribed output voltage, and outputs the prescribed output voltage;

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the output control circuit of the master power source circuit outputs the synchronous oscillation signal synchronized with the switching signal to a control circuit of the slave power source circuit; and

the control circuit of the slave power source circuit causes the switching signal to be in synchronism with the switching signal of the output control circuit of the master power source circuit based on the synchronous oscillation signal.

Claim 35 (Currently Amended): A multiple output power source apparatus comprising a plurality of power source circuits which respectively comprises a converter that is driven by a switching circuit, converts an input voltage into a prescribed output voltage, and outputs the prescribed output voltage; and an output control circuit that controls the converter, the plurality of power source circuits being connected to a single power source, wherein

each of the output control circuit circuits comprises:

a stabilizing circuit that stabilizes the output voltage of the converter to a prescribed value by monitoring the output voltage of a converter of own power source circuit and controlling the switching signal; and

a shutdown circuit that detects an abnormality of own power source circuit to output an abnormality signal to output control circuits of an other power source circuit selected from the plurality of power source circuits, and inputting an abnormality signal outputted from the output control circuit of the other power source circuit to shut down the own power source circuit when

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an abnormality is detected either in the own power source circuit or in the other power source circuits, each of the output control circuits being operably coupled to each other,

an output control circuit in a specified master power source circuit of the plurality of the power source circuits outputs via a first terminal a synchronous oscillation signal synchronized with the switching signal to an output control circuit of a slave power source circuit selected from the plurality of the power source circuit, and outputs the abnormal signal from the master power source circuit by stopping the synchronous oscillation signal outputted through the first terminal; and

the output control circuit of the slave power source circuit inputs the synchronous oscillation signal outputted from the output control circuit in the master power source circuit via a second terminal to perform synchronous control which causes the switching signal to be in synchronism with the switching signal of the output control circuit of the master power source circuit based on the synchronous oscillation signal, and outputs the abnormality signal by stopping the synchronous oscillation signal outputted through the second terminal.

Claim 36 (Currently Amended): A multiple output power source apparatus comprising a plurality of power source circuits which respectively comprises a converter that is driven by a switching circuit, converts an input voltage into a prescribed output voltage, and outputs the prescribed output voltage; and an output control circuit that controls the converter, the plurality of power source circuits being connected to a single power source, wherein

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the plurality of power source circuits respectively comprise:

a master power source circuit; and

one or a plurality of slave power source circuits, each output control circuit of the slave power source circuits being connected to the master power source circuit through a synchronous line,

an output circuit of the master power source circuit comprises:

an oscillator that generates a clock signal having a prescribed frequency and outputs a synchronous signal synchronized with the clock signal to the synchronous line;

a first stabilizing circuit that stabilizes the output voltage of the converter to a prescribed value by controlling the switching signal based on the clock signal oscillated at the oscillator;

a first shutdown circuit that detects an abnormality of the master power source circuit to output an abnormality signal to the synchronous line, detects an abnormality signal outputted to the synchronous line from the output control circuit of the slave power source circuit, and shuts down the master power source circuit when an abnormality is detected either in the master power source circuit or in the slave power source circuits, and

output control circuits of the slave power source circuits respectively comprise:

a second stabilizing circuit that stabilizes the output voltage of the converter to a prescribed value by controlling the switching signal based on the synchronous signal output to the synchronous line; and

a second shutdown circuit that detects an abnormality of the slave power source circuits

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to output an abnormality signal to the synchronous line, detects an abnormality signal outputted to the synchronous line from the output control circuit of the slave power source circuits, and shuts down the slave power source circuits when an abnormality is detected either in the master power source circuit or in the slave power source circuits, each of the output control circuits being operably connected to each other.

Claim 37 (Previously Presented): The multiple output power source apparatus according to claim 36, wherein the master power source circuit and the slave power source circuits output the abnormality signal when the synchronous line is grounded, and
the first and second shutdown circuits measure time during which the synchronous signal is stopped and cause the power circuit to be shut down when the measured time is a prescribed time or longer.

Claim 38 (Previously Presented): The multiple output power source apparatus according to claim 36, wherein the master power source circuit and the slave power source circuits output the abnormality signal when a prescribed voltage is superposed on the synchronous line.